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"Express Mail" mailing number RB40731148

Date of Deposit April 1, 1992

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Cynthia E. Blakely

Cynthia E. Blakely

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WIRE MANAGEMENT GROMMET

Cross Reference to Related Applications

This application is a continuation in part of application Serial No. 07/770,019, filed October 1, 1991. ^{now abandoned}

Field of the Invention

The invention relates generally to devices that allow wires to pass through surfaces of furniture, and, more specifically, to an improved grommet assembly possessing a slot opening and captive slot closure member which allows passage of wires and cables and their connectors through the surfaces of various types of furniture such as computer furniture, office desks, factory workstations, and the like.

Background of the Invention

The principal utility of the invention is to provide a means for routing wires, cords and connectors from electrical devices through the surfaces of furniture articles to their intended destinations. The invention serves the practical needs of both protecting the wires from sharp unprotected edges caused from boring an access channel through the surface of a furniture article and of increasing the available surface workspace by channeling the wires neatly into discrete openings instead of running such wires across the surface of the furniture object.

Devices for routing wiring through the surfaces of furniture articles exist. One such device is shown in U.S. Design Pat. No. 285,044 of Mockett. This device comprises an annular liner member and a flat circular disk-shaped cap having a slot-like opening sized to accommodate the passage of wires or cords. The liner comprises a cylindrical sleeve and a collar that extends about the outer circumference of one end of the sleeve. The liner is inserted into a slightly larger sized hole bored in the surface of a furniture object until the collar of the liner comes to rest against the furniture's surface. The liner has a central bore which is relatively large to enable connectors and plugs to be passed through it; that opening is much larger than the opening required to accommodate the wires or cables to which the plugs or connectors are connected. The wiring or cord is then placed into the cap's slot-like opening and the cap is mounted within the liner until the underside of the cap rests against the liner's collar. In its mounted position, the cap's top surface is above and not coplanar with the furniture surface. The cap closes the liner opening except for the slot in the cap through which the wires, cords or cables pass.

Another type of device is shown in U.S. Pat. No. 3,783,175 of Timmons. Like the Mockett device, this device comprises a liner member and a disk-shaped cap possessing a slot opening for the passage of an electrical cord through an office desk. The liner in this device does not contain a collar like the liner in Mockett. The liner is inserted into a slightly larger hole bore in the surface of the office desk such that one of its ends is slightly recessed from the surface of the office desk. The electrical cord is then placed into the cap's slot opening and the cap is then mounted within the sleeve. Unlike Mockett, when mounted within the liner, the cap's surface is coplanar with the surface of the office desk.

Another type of device is shown in U.S. Pat. No.

4,053,701 of Ogilvie et al. This device comprises a liner member and a cap member having a slot opening for the passage of wires through the surface of a furniture article. The liner member comprises a three sided U-shaped sleeve. The sleeve is slidably inserted into a slightly larger U-shaped channel cut into the surface of a furniture article proximate a marginal edge. The cap comprises a rectangular flat disk that is slid into the U-shaped liner such that the cap's outer marginal edge is coterminous with that of the furniture object. Wiring is then inserted into the cap's opening and through the surface of the furniture article.

Devices of the kind reviewed above are known in the furniture industry as wire management grommets. The devices in Mockett, Timmons, Ogilvie et al have a disadvantage. They do not provide cover for the cap opening when the grommet is not in use, i.e., when no wires or cords are passed through the hole in the work surface in which the device is installed. Thus, when not being used to route wiring through the surface of a furniture article, the furniture surface is left with an open hole. This is aesthetically undesirable. It is also functionally objectionable. Material on the work surface can fall through the open hole.

For maximum utility and convenience a grommet that is not in use should provide a means to cover the unused opening, a means that is readily available, easy to use and which, when placed in position, is as inconspicuous as possible. Accordingly, a device that provides for convenient, complete and secure covering of the cap opening when not in use is highly desirable.

Devices which address the need to provide a closure for a cap opening in wire management grommets are known. These devices are similar to those described above. But they also provide a separate cover or closure that can be placed in the cap opening when the opening is not being used for the passage of wires or cables. However, their

B utility is limited. Because the cap opening^{Cover} is not captive to the cap, it can be easily lost or misplaced.

Other devices have tried to remedy this security problem by providing a storage receptacle in the underside of the cap for the separate closure member. While an improvement, it is less than an ideal solution. Because the cap opening cover is separate, it can be easily dislodged from its storage position and lost. For best security, the cover should be a captive part of the cap.

A device that attempted to address this latter problem is shown in U.S. Pat. No. 4,730,363 of Asbaghi. This device comprises a annular liner and a flat-topped cylindrical cap having both an opening and a retractable closure for that opening movably held captive to the cap. The liner comprises a cylindrical sleeve and a collar extending about the circumference of one of the sleeve's ends. The liner is inserted within a slightly larger hole bored into the surface of a furniture article until the collar's underside rests against the surface of the furniture object. The cap is then inserted within the liner until the cap's underside comes to rest on the collar's top surface. The cap contains a closure or lid captive to the cap and which can be positioned to cover the cap opening when not in use, i.e., when no wires or the like are passed through the cap opening. A retaining rail depends from the underside of the cap and is positioned across the closed-end portion of the slot-like cap opening such that a gap, equal to the thickness of the lid, exists between the retaining rail and the closed end of the opening. The lid resides within the gap and comprises a bar depending from the underside of the lid positioned across the width of the lid proximate its end communicating with the closed end of the cap opening. The length of the bar is greater than the width of the gap. Accordingly, when pulled upward and away from the cap's top surface, the lid is prevented from disengaging the cap through interaction between the retainer rail and the bar.

The lid also comprises a lip that depends from the underside of the lid which restricts the downward travel of the lid through the gap. In the closed position, the lid covers the cap opening and is coplanar with the cap's top surface. To expose the cap opening, the marginal edge of the lid is lifted upward causing the lid to slide loosely downward within the gap until the lid's lip comes into contact with the cap's retainer rail.

Although this device addresses the need for furnishing a captive member to cover the cap opening, it has several disadvantages. In the vertical stored position, the slot cover hangs from the center of the cap. This leaves the cover as well as its support mechanism clearly visible, a feature that is aesthetically undesirable. The design also allows the tip of the cap cover to protrude above the surface of the cap thus creating an irritating obstruction in an otherwise smooth work surface. Hanging the cover from the center of the cap also has a functional disadvantage. The cover hangs in a position adjacent to the opening and can hinder the clear passage of wires or cables through the cap opening.

Further disadvantages of the current art relate to the integrity of the cover when placed within the cap opening. Friction between cap and cover surfaces or between cover and liner surfaces is commonly relied upon to keep the cover securely in position within the cap opening. The disadvantage is that as the contact surfaces wear, the cap and cover become less secure. In cases where the contact is between the cover and interior liner surface, when the cap is removed from the liner, the cover is unsupported and easily falls out of the cap opening.

In a device for routing wires and cords from electrical devices through the surfaces of furniture articles to their intended destinations, it is highly desirable that the device comprise a captive cover to close the cap opening when not in use. A need exists for such a wire management grommet device which is free of the

deficiencies noted above.

Summary of the Invention

This invention addresses the need identified above. It does so by providing a wire management grommet assembly which includes a cap having an improved closure member for closing an opening in the cap. The closure member is movably captive to the cap in such a manner that the closure member is held firmly in its closed position and cannot inadvertently be moved from it. Also, the closure member, when moved to its open position, does not extend above the cap surface and does not interfere with wires, cords or cables engaged in and passing through the cap opening. These benefits are achieved in an assembly which is reliable, efficient and easy to use.

Generally speaking in structural terms, this invention provides a cover for a wiring aperture through a surface of an item of computer furniture and the like. The cover comprises a cap-like plug member and a closure member for an opening formed in the plug member. The plug member includes a body having a planform shape similar to but larger in dimension than a selected wiring aperture to be covered. Projection means depend from a reverse surface of the body for mating with the boundaries of the aperture with a peripheral margin of the body in overlying relation to the surface in which the aperture is present. The projection means are located on the body about a space located substantially centrally of the body; the space opens away from the body reverse surface. A plug member opening is defined in the body. The opening extends from an inner portion of the body to and through the peripheral margin of the body. The closure member for that opening is held captive to the body in a manner which affords movement of the closure member relative to the body between closed and open positions. In its closed position, the closure member closes the body opening and has an edge essentially continuous with the body

peripheral margin adjacent the opening. In its open position, the closure member depends from the body reverse surface in the space without projection above an obverse surface of the body at such a location in the body that the body opening is fully open. The closure member has an obverse surface which is substantially flush with an obverse surface of the body in the closed position of the closure member in the body. There are means which cooperate between the plug and closure member for releasibly holding the closure member in its closed position.

The cover can be used directly in the aperture in the item of computer furniture and the like, if desired. Preferably the cover is used in combination with a tubular liner which is placed in that aperture, and the cover is placed in the liner. The plug member can have circular, rectangular or other planform configurations as desired, and there can be more than one plug member positionable in a given liner. Where plural plug members can be used with a rectangular liners, it is advantageous that the liner opening have an aspect ratio (ratio of length to width) of 2.

1 Brief Description of the Drawings

5 The above-mentioned and other features of the invention are more fully set forth in the following description of the presently preferred and other wiring grommets, which description is presented with reference to the accompanying drawings in which:

10 FIG. 1 is a plan view of the top surface of the presently preferred wire management grommet;

FIG. 2 is a side elevational view of the grommet cap with the closure member in its retracted or open position;

FIG. 3 is a plan view of the underside of the cap with the closure member in its closed position;

15 FIG. 4 is a bottom plan view of the cap with the closure member in the retracted position;

FIG. 5 is a bottom perspective drawing of the cap with the closure member in the retracted position;

20 FIG. 6 is a top perspective drawing of the closure member;

FIG. 7 is a bottom perspective drawing of the liner of the wiring grommet;

FIG. 8 is a cross-sectional elevation view taken along line 8-8 in FIG. 3;

25 FIG. 9 is a cross-sectional elevation view taken along line 9-9 in FIG. 3;

FIG. 10 is a top perspective view of the assembled wire management grommet assembly in a wiring aperture in an item of furniture, for example;

30 FIG. 11 is a top perspective view of the assembled wire management grommet assembly in a wiring aperture in an item of furniture, with the closure member in its retracted or open position;

35 FIGS. 12 - 19 are fragmentary perspective drawings of alternative embodiments of connections between the cap and the closure member in other wire management grommets according to this invention;

1 FIGS. 20 - 31 are views of grommet caps and liners
having geometries different from the circular structures
shown in FIGS. 1-19; and

5 FIG. 32 is a plan view of the underside of a cap
useful in the grommet assembly shown in FIGS. 29-31 with
the closure member shown in its closed position.

Description of the Illustrated Embodiments

10 In an exemplary embodiment shown in FIGS. 1-10, a
wire management grommet 1 affords passage of wiring and
cords through an aperture 2 formed in the surface 3 of a
furniture article 4; surface 3 can be countersunk around
aperture 2, if desired. The grommet comprises a generally
15 circular annular liner 46 and a complementary generally
circular, disk-shaped cap 10; see FIG. 10. The liner and
cap may be molded from plastic, metal, or the like which
may be colored in a manner suitable for use with a variety
of home, office, or work furniture. The cap cooperates
20 with the liner in the manner of a plug for the central
passage through the liner.

 As shown in FIG. 7, liner 46 comprises an annular
sleeve 50 that is cylindrical in shape. A collar 54 is
integral to the sleeve and extends perpendicularly outward
from one end of the sleeve forming a lip about the
25 circumference of the liner. Aperture 2 is formed in the
surface 3 of the furniture article and is sized to
accommodate the insertion of the liner sleeve. Collar 54
serves two functions, first to limit the insertion of the
liner within the hole of the furniture article through
30 contact of the collar with the surface of the furniture
article, and second to provide a uniform surface upon
which to mount cap 10. A plurality of ribs 52 extend from
the outside surface of the liner and are positioned
parallel to the length of the sleeve. The ribs serve to
35 ensure that the liner fits snugly within the aperture in
the furniture article.

 FIG. 1 shows the top (obverse) surface 11 of a body

1 12 of cap 10 has an opening 16 in which is located a
closure member 18. The closure member is shown in its
closed position in solid lines in FIG. 16, and in broken
5 lines in an extended position which is discussed more
fully below. In the closed position, the closure member
is fully inserted into opening 16. In this position, the
opening is completely closed by the closure member with
a top (obverse) surface 13 of the closure member being
10 coplanar with the cap surface 11 and having an end edge
15 coterminous with a beveled peripheral edge 14 of the
cap. In the extended position, the closure member 18 has
been slidably moved in opening 16 outwardly away from a
closed end 17 of that opening located at a substantially
15 central position of cap body 12. The closed end 17 of
opening 16 preferably is arcuately curved as shown in FIG.
1; however, see FIG. 21 for a cap opening of different
configuration. In the extended position, the top surface
13 of the closure member remains coplanar with cap surface
11; however, its end marginal edge 15 now lies outwardly
20 of cap edge 14. Opening 16 in cap 10 is in the form of
a wide slot extending radially of the cap from a central
place in the cap to the cap perimeter; opening 16 has
opposing parallel sides between its closed end 17 and the
cap perimeter. As set forth below, cap openings having
25 different geometries are possible in a wire management
grommet according to this invention.

FIG. 2 shows a side view of cap 10 with the closure
member 18 in its retracted position perpendicular to the
underside of the (reverse surface) cap body. The closure
30 member's initial retracted position is shown in broken
lines and is achieved by rotating the closure member
downward from its extended position shown in broken lines
in FIG. 1. The closure member's final retracted position
is shown in solid lines in FIG. 2 and is achieved by
35 slidably translating the closure member laterally in the
body from its initial retracted position in a direction
away from slot opening 16.

1 In the final retracted position of the cover
relative to the cap, the slot opening is completely
uncovered, permitting ready and convenient passage of
wiring and such through the slot opening. Also shown is
5 the cap's continuously beveled edge 14 and the
complementary edge 15 of the closure member. A skirt 20
is shown to depend from the underside of the cap body.

FIG. 3 is a bottom plan view of cap 10 with the
closure member 18 in its closed position completely
10 covering and closing the slot opening 16. The closure
member 18 can be seen residing between a pair of ribs 22a
and 22b preferably formed integral to cap 10 and depending
from its underside parallel to each of the preferably
parallel sides of the slot opening. The ends of ribs 22
15 terminate through contact with the inside wall of the
skirt. A stop 26 extends from one rib 22b into the path
of sliding motion of the closure member in the cap. The
stop serves two functions, one being to limit the outward
travel of the closure member from its closed to its
20 extended position, and the other to restrict the travel
of the closure member towards the open end of the slot
opening while perpendicular to the cap (see FIG. 5),
thereby keeping the closure member captive to the cap.
A stop clearance opening 36, formed in the adjacent edge
25 of the closure member (see FIG. 6) in a tang portion 19
of the closure member, is registerable with the stop 26
to permit the free pivotal movement of the closure member
from its fully extended position (FIG. 1 broken lines)
downward relative to the cap body (to the position shown
30 in broken lines in FIG. 2) without interference by the
stop.

FIG. 4 is a bottom plan view of the cap with the
closure member 18 in a retracted position perpendicular
to the cap's underside surface. In this position the slot
35 opening is completely uncovered. The stop 26 can also be
seen performing its function of restricting the closure
member's travel into the slot opening while in this

1 retracted position.

FIG. 5 is a bottom perspective view of the cap's underside showing the slot closure member 18 in solid lines in its initial retracted position perpendicular to the cap's surface. The closure member's final retracted position, translated away from the slot opening 16, is shown in broken lines. The cap 10 is fitted to the liner 46 through interaction between the liner sleeve 50 and the skirt 20 which preferably is integral to the underside of the cap. The skirt depends from the underside surface of the cap in the range of from 1/4 to 1 inch and is configured to nest snugly within the liner sleeve. The cap is inserted within the liner until the cap's underside comes to rest on the top surface of the liner collar 54. A pair of grooves 23 are shown to exist between each rib 22a and 22b and the underside surface of the cap. A pair of flanges 24a and 24b are shown to extend from the lower surface of each rib in a direction away from the body reverse surface from a location on each rib near the closed end of slot opening 16 to the end of rib remote from that opening. The flanges cooperate with the wall sides of the closure member in its tang portion and serve to stabilize the closure member's sliding and vertical movement within the cap.

FIG. 6 shows the closure member and its preferably integral components. A boss 30 extends outwardly away from the top surface of the closure member proximate to the end cooperating with the slot opening. The boss is sized and shaped to both complement the configuration of the slot opening and to exist in a coplanar arrangement with the cap while in its closed position. A tongue 32 extends perpendicularly outward from each side of the closure member proximate the boss. The tongues 32a and 32b are sized to permit slidable cooperation within their respective groove 23 formed in respective ribs 22a and 22b as shown in FIGs. 3, 5 and 9. The tongue and groove interaction facilitates the slidable movement of the

1 closure member within the cap from its closed position to
its extended position. A detent boss 34 extends upwardly
from the surface of one of the tongues 32b. The detent
boss is positioned to cooperate with a detent recess 28
5 (see FIG. 5), located on the cap's underside surface
proximate the slot opening, when the closure member is
slid from its extended position into the slot opening.
The coaction of the detent boss in the detent recess
provides a releasable latch which holds the closure member
10 in its closed position in the cap.

A base flange 35 is positioned proximate the end of
the closure member opposite the boss, as shown in FIGs.
3, 6 and 8. The base flange extends perpendicularly
outward from the distal end of the closure member tang and
15 serves to limit its pivotal motion in the cap to a
position perpendicular to the cap's underside surface.
A wall 40 extends forwardly (toward closure member end 15)
from each of the two opposite edges of the base flange.
Walls 40 cooperate with cap flanges 24 upon movement of
20 the closure member within the cap to stabilize the closure
member's downward vertical (hinging) movement and to
minimize unwanted lateral movement.

A pin 42 extends perpendicularly outward from each
of the two long edges of the closure member in the plane
25 of the base flange 35. The pins 42a and 42b are sized to
slidably and hingeably interact within their respective
grooves 23 as shown in FIG. 8.

Closure member 18 is captive to cap 10 through the
cooperation between pins 42 and the respective grooves 23.
30 The configuration of the cap and its components ensures
the captivity of the closure member through constant pin
and groove interaction by two distinct mechanisms. The
stop 26 serves to restrict the movement of the closure
member towards the pair of groove openings proximate the
35 mouth of the slot opening while the interference between
the inner wall of the skirt 20 and walls 40 prevents the
closure member from sliding out the distal ends of grooves

1 23. The closure member preferably is introduced between
the ribs of the body to a position perpendicular to the
underside of the cap and is snapped, by a twisting motion,
5 into its installed position such that the pins 42 are
contained within each respective groove 23 and thereafter
are captive to the body.

To use the wire management grommet, a wiring aperture
must first be formed in the surface of the desired
furniture article. The aperture is sized to snugly
10 accommodate an approximately similarly shaped liner sleeve
50. Liner 46 is then inserted into the aperture until the
bottom surface of the collar comes to rest on the
furniture surface, or on a countersunk surface in surface
3 around the aperture in those cases where it is desired
15 that the top of the installed grommet be flush with the
furniture surface. The appropriate wire or cable plugs
or connectors are passed through the liner. The wiring
is then placed in slot opening 16 and the cap is installed
by inserting the cap skirt 20 within the liner sleeve
20 until the cap's underside surface comes to rest against
the top surface of the liner collar. The liner may
accommodate a single cap or multiple caps depending on the
particular configuration of liner chosen. FIG. 24 shows
an aspect ratio of 2:1 between square shaped caps and a
25 rectangular shaped liner. FIG. 30 shows an aspect ratio
of 2:1 between quadrant shaped caps and a semi-circular
shaped liner. The liner will accommodate the cap with
the closure member in either its closed or retracted
position. FIG. 10 shows the wiring grommet installed with
30 the closure member in its closed position covering the
slot opening. The cap must be removed from the liner when
it is desired to change the closure member's position in
the cap to open the slot opening. FIG. 11 shows the
wiring grommet installed with the closure member in its
35 open position retracted within the body.

Three distinct modes of motion pertain to the
movement of closure member 18 from its closed position in

1 slot opening 16 to its fully retracted position
perpendicular to the underside surface of cap 10. Those
modes are slide, pivot and translate. First, from its
5 closed position, the closure member is slid outwardly in
the slot opening so that boss 30 moves away from the
closed end 17 of the opening. This causes the detent
mechanism 28, 34 to uncouple permitting the closure member
to slide easily through the cooperation between the
10 tongues 32a and 32b and grooves 23. After the detent
mechanism has uncoupled, the closure member is further
extended, causing the tongues to travel past the grooves
23 (see FIG. 1). The outward extension of the closure
member is complete when the pertinent one of walls 40
15 engages the stop 26. In this position the closure member
is fully extended with the tongue and groove arrangement
completely disengaged.

Next, from its fully extended position, the closure
member is hingedly pivoted downward and away from the cap
top surface. The hingeable movement is facilitated
20 through cooperation between the closure member pins 42 and
cap grooves 23. The hinging movement of the closure
member is stabilized through the interaction between cap
flanges 24 and closure member walls 40. The closure
member's downward rotation is complete when base flange
25 35 abuts the underside surface of the cap between ribs 22.
In this position, the slot closure is completely retracted
from the slot opening and lies perpendicular to the cap.


While in the hinged and retracted position
perpendicular to the cap, the closure member is slidably
30 translated laterally to a position in the cap spaced from
opening 16; such position is represented by the broken
line 45 in FIG. 4. This sliding movement is facilitated
through the interaction between the pin and groove
arrangement of the closure member and cap, respectively.
35 The sliding movement of the closure member within the cap
is also stabilized through the same flange and wall
cooperation that served to stabilize the closure member's

1 hinging movement.

 The wire management grommet of the present invention
has the advantage of having a closure member that is
captive to the cap. Because the closure member is captive
5 into the cap, it cannot become lost or misplaced after
removal from the slot opening when the device is to be
used. Also, the closure member is inconspicuous and out
of sight when the device is being used. It is
aesthetically pleasing to see only the clean routing of
10 wires from the furniture surface. Further, the closure
member can be translated away from the closed rear end of
the slot to be out of the way and to not interfere with
the actual routing of the wires through the device.

 The wire management grommet of the present invention
15 has the additional advantage of having a captive closure
member that is firmly locked into its position covering
the slot opening. The locking feature is desirable since
it keeps the closure member within the slot opening
whether within or out of the liner unit.

20 The foregoing descriptions pertain to a presently
preferred wire management grommet assembly according to
this invention. The benefits and advantages of the
invention can be achieved in caps having different
connection arrangements between the cap and closure member
25 for providing and affording suitable relative motions
while keeping the closure member captive to the cap. For
example, FIGS. 12 and 13 schematically illustrate other
arrangements for limiting the outward extension of the
slot closure relative to the cap. In FIG. 12, a cap 60
30 has a slot opening 61 in which a closure member 62 is
similar to closure member 18 except that, in a tang
portion 63, it defines a slot 64 which has a length
between its closed ends which corresponds to the amount
of sliding motion experienced by the closure member in
35 moving between its closed and extended positions in the
plane of the cap. The slot cooperates with a pin 65 which
depends into it from the underside of the cap. The pin



1 engages the closed ends of the slot to provide a stop
limiting sliding motion of the closure member in the cap
without interfering with the ability of the closure to
pivot and to translate in the cap.

5 The arrangement shown in FIG. 13 uses a cap 66 and
a closure member 67 which is similar to closure member 18.
At its distal end, the closure member carries a hinge axle
68 which extends outwardly of the long sides of the
closure member, the ends of which can cooperate in guide
10 grooves (not shown) similar to those shown above. A pair
of lugs 69 depend from the underside of the cap on
opposite sides of the closure member for guiding the
closure member in its sliding motion in the cap. The lugs
have in-turned lower ends 70 which extend under the tang
15 portion of the closure member to hold the closure parallel
to the cap until the axle ends about the lugs in the
extended position of the closure member relative to the
cap, at which point the lug ends 70 register with notches
71 formed in the tang edges immediately forward of axle
20 68. Such registration allows the closure member to be
pivoted relative to the cap to clear it from the cap slot
opening.

FIGS. 14, 15 and 16 schematically illustrate
arrangements for hinging the closure member in the cap.
25 In cap 73 (FIG. 14), closure member 74 carries a
transverse hinge axle 68 at its distal end. The ends of
the axle cooperate rotatably in openings formed in hinge
lugs 75 which depend from the cap on opposite sides of the
closure member in substantially spaced relation to the
30 closed end of the cap slot opening. The closure is
moveable only hingeably relative to the cap between a
closed position in the slot opening and an open position
in which it depends from the cap well to the rear of the
slot opening and is out of the way as wires and cables
35 pass through the cap.

Cap 76 (FIG. 15) has a closure member 67 which
carries a transverse hinge axle 68 at its distal end. The

1 projecting ends of the axle cooperate in elongate slots
77 formed in elongate lugs 78 which depend from the cap
along the sides of the tang portion of the closure member
for guiding the closure member in slidable motion parallel
5 to the plane of the cap. The axle is captive in the lug
slots. The axle provides for pivoting and for translation
of the closure member relative to the cap in a manner
consistent with the foregoing description of cap 10.

Cap 80 (FIG. 16) has a closure member 81 which
10 carries tongues 32 adjacent its proximal end for
cooperation in grooves defined by the cap to guide the
closure member in sliding relative to the cap. At its
distal end, the closure member carries a transverse bridge
15 82 which extends above the tang position and through an
elongate slot 83 in a lug 84 which depends from the cap.
The cooperation of bridge 82 and lug 84 enables the
closure member to pivot downwardly from its extended
position (defined by the forward end of slot 83) and to
translate in the cap to a limit defined by the distal end
20 of slot 83.

Cap 73' shown in FIG. 17 is a modification of cap 73.
A slot 84 is formed through the tang portion of closure
member 74. A pin 85 having a bulbed lower end 86 depends
from the cap and into and through slot 84 when the closure
25 member is in its closed position in the cap. The bulbed
end of the pin has an interference fit with slot 84 and
serves as a releasable detent to hold the closure member
in its closed position.

FIG. 18 shows that a pin and slot detent mechanism
30 of the kind described with reference to FIG. 17 can be
used in association with the distal end of a closure
member which is slidable in the cap as well as pivotable
and translatable. Cap 87 has a pin 88 which depends from
its reverse surface and which cooperates in a slot 89
35 disposed parallel to the length of the closure member and
which opens to the distal end of that member. The pin
disengages from the slot when the closure member is slid

1 in the cap from its closed to its extended position to
become free for hinging motion. The pin does not hinder
the closure member in pivoting and translating relative
to the cap in moving from its extended to its fully open
5 and retraced position in the cap.

Cap 90 (FIG. 19) provides a lug 91 which depends from
the cap into an elongate opening 92 formed in the central
part of the closure member tang portion between its boss
and its laterally extending distal axle projections. The
10 lug has an opening 93 in its lower end which cooperates
with a finger 94 which extends rearwardly from a forward
edge of opening 92. The finger and opening 93 are engaged
when the closure member is in its closed position and
during an initial part of the sliding movement of the
15 closure member from its closed position toward its
extended position. Such engagement holds the closure
member parallel to the cap and guides it linearly in such
motion. The finger disengages from the lug opening when
the closure member reaches its extended position. The
20 closure member can thereafter pivot downwardly relative
to the cap and can then translate in the cap to its
retracted open position rearwardly from the closed end of
the cap slot opening. The lug prevents the closure member
from translating toward the cap slot opening out of
25 captive engagement with the cap.

FIGS. 20-32 show geometries of wire management
grommets according to this invention which are different
from the circular grommet assembly shown in FIGS. 1-11,
each of which preferably includes at least one cap opening
30 closure member which has the same motion guiding,
detenting, enabling and limiting structural interrelation
to its cap member as closure member 18 has to cap 10 as
set forth in the foregoing description pertinent to FIGS.
1-11. A rectangular cap 100 (FIG. 20) of suitable plan
35 length and width includes three closure members 18 which
cooperate with respective marginal slot openings in the
cap. Two closure members cooperate with one of the long

1 edges of the cap, and the third one cooperates with the
other cap long edge, preferably centrally between the
first two closure members. A further rectangular cap 102
(FIG. 21) has formed in one long side thereof a marginal
5 slot opening 103 which has a width parallel to the length
of the cap which is greater than its depth parallel to the
width of the cap. A single closure member 104 has a boss
portion 105 which is shaped correspondingly to the shape
of opening 103.

10 Cap 110 (FIG. 22) is configured for use in a
furniture wiring aperture which is elongate and has
arcuately curved ends. Cap 110 has a marginal slot
opening in each of its opposite ends with which a closure
member 18 cooperates in the manner described above. FIG.
15 23 shows a cap 112 which has an overall configuration the
same as or similar to that of cap 110 but which is divided
in half transversely into two cooperating cap parts 113
and 114 which register with each other along abutting
preferably straight edges 115 and 116, respectively, when
20 the cap is assembled in a furniture wiring aperture. The
cap parts can be and preferably are identical. Each has
a slot aperture 16 formed in it along its straight edge
centrally of the length of that edge, and a closure member
18 is carried by each cap part for cooperation with that
25 slot opening in the manner described above. In use, one
or the other or both of the slot openings in the two cap
parts can be opened to provide a passage for one or more
wires or cables through the central position of cap 112.

30 Cap 117 (FIG. 24) is configured in the shape of a
square for use in a furniture wiring aperture or liner 118
that is either square or rectangular in shape. Cap 117
has a marginal slot opening at one of its edges 119 with
which a closure member 18 cooperates in the manner
described above. FIG. 24 shows a pair of identical square
35 caps 117 combined together to fit within a rectangular
liner 118 having a width approximately equal to the
dimension of the square cap and a length equal to twice

1 the width. Upon insertion within the rectangular shaped
liner, three edges of each cap cooperates with the liner
while the caps register with each other along abutting
edges. The position of the slot openings within the
5 rectangular liner is dependant upon which of sixteen
possible ways the caps are combined. FIG. 24, 26, and 27
shows the three possible combinations that result from
combining the caps in a symmetric manner. FIG. 24 shows
the caps symmetrically arranged with the marginal edge of
10 each slot opening 119 in cooperation with a common length
of the rectangular liner 118. FIG. 25 shows a bottom plan
view of both caps arranged in this fashion with one of the
closure members 18 in its closed position and the other
in its opened and retracted position. FIG. 26 shows the
15 caps symmetrically arranged with the marginal edge of each
slot opening 119 opposed to one another and in cooperation
with the opposite narrow edges of the rectangular liner
118. FIG. 27 shows the caps symmetrically arranged within
the rectangular liner such that the marginal edge of each
20 cap slot opening 119 abuts the other. FIG. 28 shows a
single square cap 117 residing within the rectangular
liner 118.

Caps 120 and 121 (FIG. 30) are configured in the
shape of a quadrant of a circle for use in a furniture
25 wiring aperture or liner having either a quadrant, semi-
circularly, or completely circularly shaped furniture
wiring aperture. FIG. 29 shows the practical application
of caps 120 and 121 within a semi-circularly shaped
furniture wiring aperture positioned where the furniture
30 surface adjoins a vertical wall. Caps 120 and 121 each
have an opening along the marginal edge of their arc
length that extends circumferentially from a position
proximate the center of the cap's arc length to the
quadrant's radial edge; a closure member cooperates with
35 this opening in the manner described above. Caps 120 and
121 are different (mirror images of each other) because
of the opposed placement of each cap's opening. That is,

1 cap 120 is a left-hand cap and cap 121 is a right-hand
cap. FIGS. 30 and 31 show caps 120 and 121 combined to
fit within a semi-circular shaped liner 122 having a
diameter approximately equal to twice the cap's radius.
5 The caps are arranged within the semi-circular liner such
that the circumferential edge of each cap cooperates with
the circumferential edge of the liner. The position of
each cap's opening within the liner is dependent upon
which of two possible ways the caps are combined. FIG.
10 30 shows the caps arranged with the cap openings abutting
one another, forming one continuous opening. FIG. 31
shows the caps arranged with the cap openings occupying
diametrically opposed positions within the semi-circular
liner. FIG. 32 shows a bottom plan view of a quadrant-
15 shaped cap 120 with the closure member 18 in the closed
position. Two caps 120 or two caps 121 could be used with
liner 122, if desired.

Each of caps 100, 102, 110, 112, 117, 120 and 121 can
be used with or without a cooperating wiring aperture
20 liner, as desired. The use of an aperture liner is
preferred. Further, the configurations of caps 113, 114,
117, 120 and 121 permit a variety of cap and accommodating
furniture wiring aperture or liner use combinations. For
example, in FIG. 30 the quadrant shaped cap 120 could
25 either be used alone within the a semi-circular shaped
liner 122 or combined with cap 121 to fully occupy the
liner.

The foregoing description of presently preferred and
other arrangements of wire management grommets is not
30 intended as, nor is it to be understood to be, an
exhaustive catalog of all grommet arrangements according
to this invention. The foregoing descriptions and the
accompanying drawings show that the invention can be
practiced in diverse ways in grommet plug members of many
35 different shapes and sizes. Therefore, the foregoing
descriptions support and give meaning, scope and vitality
to the following claims which are to be read and

1 interpreted as broadly as is consistent with the relevant
art and technology and with those descriptions and things
equivalent to those which have been described.

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